An In-Line Oil Filtration System

FASTT Solution Saves Waste, Labor and Other Costs

The FASTT (Field Activity Support and Technology Transfer) Team, in conjunction with the Portsmouth Naval Shipyard (PNS) in New Hampshire, is transferring to other military installations an in-line oil filtration system that protects the environment while reducing the cost and labor required to perform routine maintenance and repair.

This in-line process is a simple technology that has been used very successfully at PNS for over 15 years. The process involves the in-line filtration of lube and hydraulic oils associated with Industrial Plant Equipment (IPE).

Background

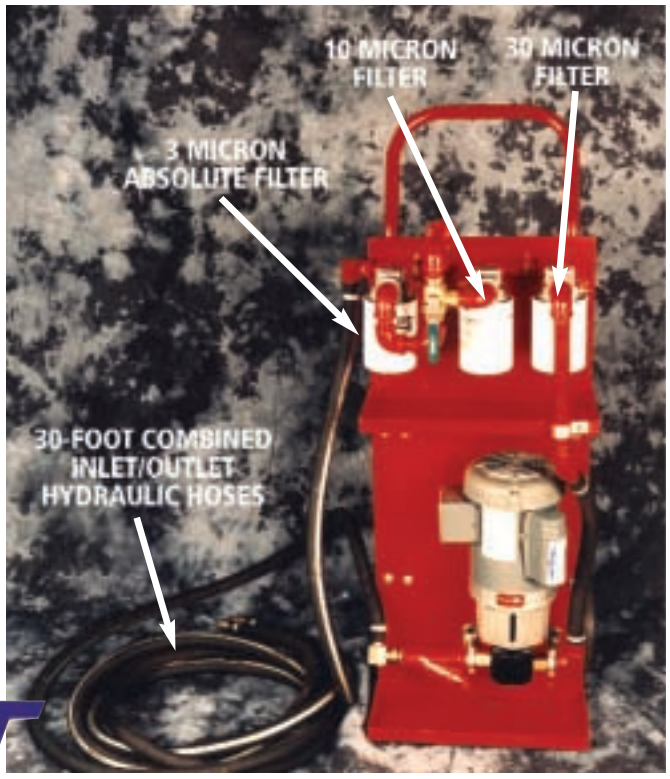
IPE includes various rotating and hydraulic machinery including lathes, milling machines, press brakes, and shears as well as Computer Numerically Controlled (CNC) shop equipment. There are over 400 different pieces of IPE at PNS with some individual sumps containing as much as 400 gallons of oil.

At most bases or depots, IPE oil is changed out on a periodic basis according to the Planned Maintenance System (PMS) schedule. Following the PMS schedule ensures that equipment is properly maintained. But the PMS schedule can also call for the change out of oil when it is not necessary (at times when the oil is still serviceable).

From an environmental point of view, it is desirable to eliminate as much of this oil from the waste stream as possible. It is preferable to purchase less oil from the supply system, thus reducing procurement costs as well as the health and safety risks associated with the handling and storage of oil. This enhanced process also reduces the burden on maintenance personnel by making the process easier and quicker.

History

In the late 1980's, the Portsmouth Tool Preventative Maintenance Shop



Features of the in-line oil filtration system.

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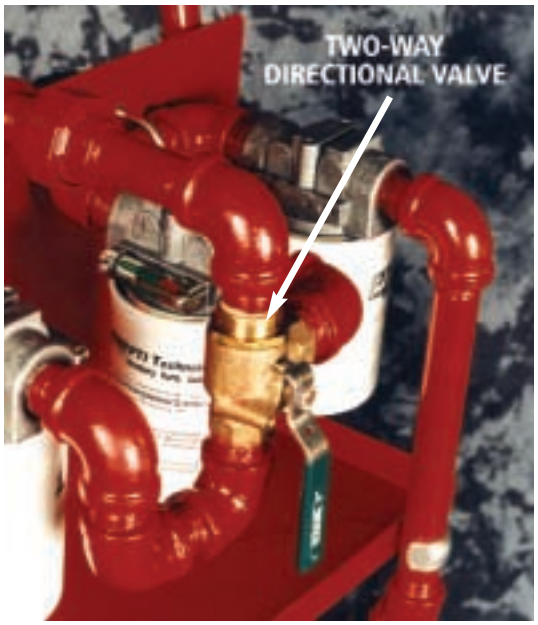

was reviewing their maintenance costs and expenses associated with their lubrication program. It was evident that there was a large effort required to maintain the current maintenance status on a large number of machines (due primarily to the frequency of oil changes). Additionally, the shipyard was purchasing and disposing of large amounts of costly lubrication and hydraulic oil.

After consultation with the machine tool manufacturers and the oil suppliers, it became evident that the oil in the sumps had minimal contaminants other than wear products (particles from the internal bearings and mating gears/surfaces). There was no source of water/solvent contamination in most of the equipment. The oil did not have any Internal Combustion Engine particulates or acids nor did it get exposed to any high heat source.

The shipyard realized that if the particle count was periodically reduced to a very low level (less than manufacturers' allowances) and some periodic sampling was used to validate the proper oil requirements for the equipment, then oil changes could be extended or eliminated thereby extending the life of the equipment.

PNS developed a solution to this problem and, along with the FASTT Team, is making it available across the Department of Defense (DoD). From 1986 through 1993, PNS personnel gradually phased in the use of a shipyard-built filtration system with periodic sampling. Oil was filtered based on machine run times. The sampling verified that the filtered oil met all manufacturers' specifications. At the same time, the number of oil types stocked in the shipyard was also reduced. The oils remaining in the supply system were the higher-grade oils that met or exceeded manufacturers specifications.

In-Line Oil Filtration Program

Over the last ten years, FASTT has observed different equipment maintenance practices at Navy, Army, and Air Force activities and wanted to pursue the most cost effective and environmentally friendly method to accomplishing IPE maintenance.

The FASTT Team gathered program cost information throughout the implementation of the program to evaluate potential savings. Program implementation continued on each piece of IPE after a "one time" thorough draining and cleaning of the sumps, as well as the installation the quick disconnect (QD) fittings and the refilling of the sumps with a high quality oil.

The filtration equipment was fabricated at the shipyard (at a cost of $2,500 in FY2002) and was equipped with the QD fittings to mate to the IPE. (These QD fittings help to minimize the labor associated with attaching the filter equipment to the IPE.)

TOP: The discharge hose from the filter system.
MIDDLE: The suction hose to the filtration system.
BOTTOM: A frontal view of the oil filtration system in operation.

PNS determined that the use of a few oil types would save costs because personnel would not have to maintain many different types of oil in the supply system. High quality oils were selected and used (as appropriate) in each of the sumps. The additional purchase cost of these high quality oils was prorated over the seven years of program implementation. The savings associated with reducing oil changes and disposal costs of waste oil more than offset the costs of procuring the high quality oil.

FASTT has successfully transferred this system to other industrial activities and instructed personnel on its use. The system has three filters that provide increased filtration (from 25 to 10 to 3 micron absolute filtration). The 3-micron absolute filtration is needed for newer CNC IPE but is not needed on older equipment. The filtration system has a valve allowing the user to bypass the 3-micron filter when it is not needed. The ability to bypass the 3-micron filter helps to extend the life of the filter equipment. The unit also has visual differential pressure indicators to indicate when a filter is expended.

The filtration schedule is established based on the PMS schedule for changing the oil. But instead of taking the IPE out of service and draining and refilling the oil sump, the rolling filtration system is quickly connected to the oil sump to operate. The filtration system does not require a full time operator. Mechanics can work on other tasks while the filtration system is operating. Oil from the IPE oil sump passes through the filters and is discharged back into the sump. The IPE can remain in service and in use while the oil from the sump is being filtered. The running time is based on the sump size. The process is complete once the volume of oil contained in the sump is processed through the filter ten times. A typical hookup to a press brake at a recent Pearl Harbor Naval Shipyard training session is pictured at left.

Program Benefits

The FASTT Team has collected some cost and performance data on the implementation of the oil filtration program. The data gathered at PNS for transferring this technology is typical of many industrial activities throughout DoD. Actual data from PNS exemplifies the potential labor and environmental savings.

At the end of the five-year phase-in PNS documented the following savings:

- Reduced Labor
  Reduced labor expenditures from $78.6K per year in 1988 to $12.9K per year in 1993. This equates to more than $78K per year savings (in 1993 dollars) and an 80 percent reduction in labor costs.
- Reduced Oil Purchases
  Reduced oil purchases from a high of $14.9K (3,500 gallons) in 1988 to $3.9K (770 gallons) in 1993. This equated to over $11K savings per year and a 78 percent reduction in oil costs.

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A typical piece of Industrial Plant Equipment.

Bob Vozzella from Portsmouth Naval Shipyard trains Yokosuka maintenance personnel on the use of the in-line oil filtration system at Pearl Harbor.

- Reduced Waste Oil Disposal Costs
  Reduced waste oil disposal costs from $1,750 to $490 and a 72 percent reduction in disposal costs.

This equates to a greater than 75 percent reduction (over $90K per year) in all associated labor, oil purchases and disposal. In addition to these reductions, no oil related equipment failures occurred and mechanics are free to complete other tasks while the filtration system is running.

Since 1993, no machine failures have occurred due to oil degradation and the shipyard has been able to maintain the oil in all its 400-plus pieces of IPE. The NAVSEA Inspector General in Fiscal Year 1987 recognized the shipyard for the innovation of this process change. It is still beneficial today.

This change in planned maintenance was done in conjunction with periodic oil sampling, and the standardization of the oil types used for IPE. This means that no oil changes are done unless there is an indication of contamination (wear particles in samples) or a maintenance shutdown requiring the drainage of the sump.

These changes have resulted in tremendous labor reductions. Oil changes are virtually eliminated. Oil purchases and disposal are reduced over 70 percent.

A Technology Transfer Success

FASTT has recommended this type of equipment to multiple activities throughout DoD. With the assistance of Phil Hanson, PNS Shop 06, the FASTT Team has manufactured several of these units for other locations. Among the Navy activities that have these in-line oil filtration systems are the Shore Intermediate Maintenance Activity (SIMA) Norfolk, SIMA San Diego, Pearl Harbor Naval Shipyard, and Ship Repair Facility Yokosuka. The FASTT Team has also provided training and guidance in the initial startup of a program. FASTT has received positive feedback from the activities on the continued support provided by PNS and FASTT personnel.

Summary

The use of this equipment benefits the environment and reduces labor for maintenance personnel. These savings are more dramatic for those facilities with large numbers of IPE (e.g., repair facilities, shipyards, and depots). The process can be implemented slowly over an entire base, immediately or on specific equipment. The FASTT Team will provide options within their recommendations. Success may not be automatic but the FASTT Team and PNS will work with the activity to meet specific needs and ensure proper implementation thereby reducing risks, protecting the environment and reducing costs. ⚓

CONTACTS

Bob Vozzella
Portsmouth Naval Shipyard
207-438-1610
DSN: 684-1610
VozzellaRC@navsea.navy.mil

Phil Hanson
Portsmouth Naval Shipyard
207-438-1179
DSN: 684-1179